

ANNUAL REPORT 1965

PORT ARTHUR

water pollution control plant

TD 367 .A56 P66 1965 MOE

DIVISION OF PLANT OPERATIONS

Ontario Water Resources Commission

TD 367 .A56 Port Arthur : water pollution control plant.

81546

P66 1965



ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Local Advisory Committee, City of Port Arthur.

Gentlemen:

I am pleased to provide you with the 1965 Annual Report for the Port Arthur Water Pollution Control Plant, OWRC Project No. 58-S-13.

We appreciate the co-operation you have extended to our Operations staff throughout the year, and trust that continuation of this close association will ensure even greater progress in the sphere of water pollution control.

Yours very truly,

D. S. Caverly, General Manager. Digitized by the Internet Archive in 2015



ONTARIO WATER RESOURCES COMMISSION

801 BAY STREET TORONTO 5

J. A. VANCE, LL.D. CHAIRMAN

J. H. H. ROOT, M.P.P.

D. S. CAVERLY
GENERAL MANAGER

W. S. MACDONNELL
COMMISSION SECRETARY

General Manager, Ontario Water Resources Commission.

Dear Sir:

I am pleased to provide you with the 1965 Annual Report on the operation of the Port Arthur Water Pollution Control Plant, OWRC Project No. 58-S-13.

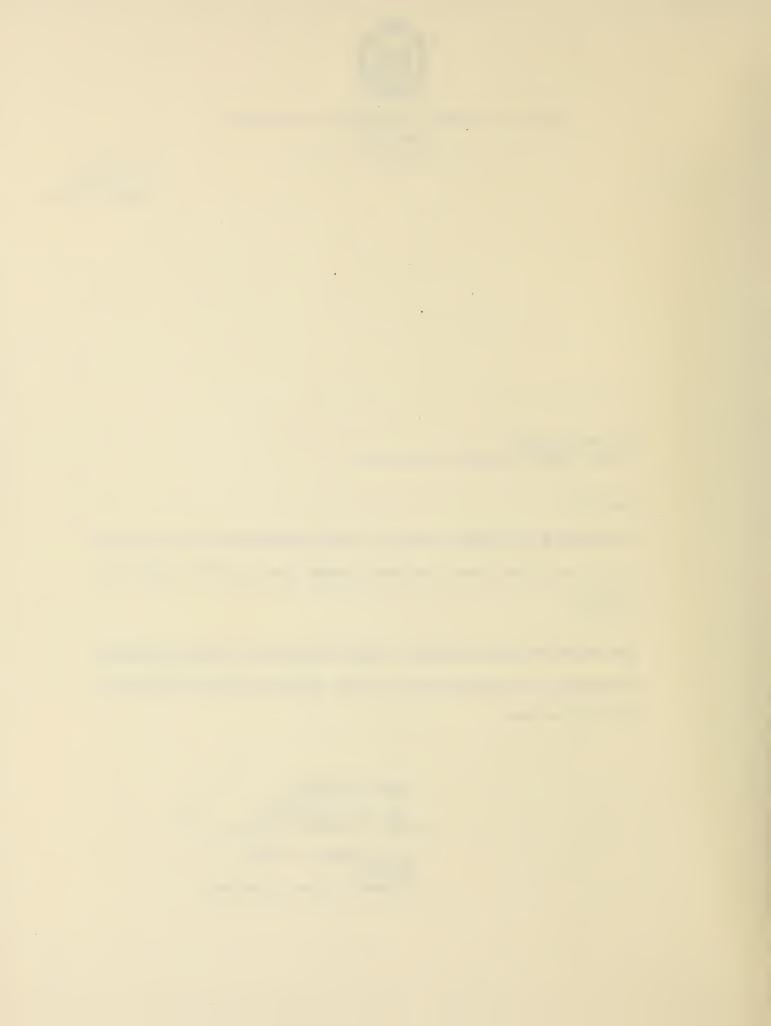
The report presents design data, outlines operating problems encountered during the year and summarizes in graphs, charts and tables all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,

Director,

Division of Plant Operations.



FOREWORD

This report provides useful information on the operating efficiency of this project during 1965. It is intended to act as a guide in gauging plant performance. To implement that aim, it includes detailed statistical and cost data, a description of the project and a summary of its operation during the year.

Of particular interest will be the cost data, which show the total cost to the municipality and the areas of major expenditure.

The Regional Operations Engineer is primarily responsible for the preparation of the report, and has compiled and arranged the material. He will be pleased to answer any questions regarding it. Other groups, however, were involved in the production, and these include the statistics section, the Drafting Section of the Division of Sanitary Engineering and the Division of Finance.

B. C. Palmer, P. Eng., Director, Division of Plant Operations.

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PORT ARTHUR water pollution control plant

operated for

THE CITY OF PORT ARTHUR

by the

ONTARIO WATER RESOURCES COMMISSION

CHAIRMAN:

Dr. James A. Vance

VICE-CHAIRMAN: J. H. H. Root, M. P. P.

COMMISSIONERS

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L. E. Venchiarutti

GENERAL MANAGER:

D. S. Caverly

ASSISTANT GENERAL MANAGER

L. E. Owers

K. H. Sharpe A. K. Watt

F. A. Voege

COMMISSION SECRETARY

W. S. MacDonnell

DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director:

C. W. Perry

Regional Supervisor:

A. C. Beattie

Operations Engineer:

A. Clark

801 Bay Street

Toronto 5

²65 REVIEW

The total plant flow in 1965 was up 14% from that of 1964. The daily average flow for the year was 5.16 mg. At no time during the year was the flow less than the design capacity of 4.0 mgd.

The cost of operation for 1965 was \$44,533.19, a decrease of \$741.68 over the previous year. No substantial increase in costs are anticipated for 1966.

No major mechanical failures occurred in 1965. However, the increased loadings on the plant brought to attention the inadequacy of the digester mixing facilities. This problem was overcome by making substantial changes to the digester piping and by relocating the mixing pump. Improvements in operation of the digester are now being observed.

Regular inspections were carried out by Division of Plant Operations engineers and technical staff.

The low unit cost of treatment \$23.64 per mg, is a reflection of the over-loading conditions prevailing at the plant.

GLOSSARY

BOD biochemical oxygen demand (a measure of organic

content)

cfm cubic feet per minute

comminution shredding of solids into small fragments

DWF dry weather flow

effluent outflow

flocculation bringing very small particles together to form a larger

mass (the floc) before settling

fps feet per second

gpcd gallons per capita per day

gpm gallons per minute

grit sand, dust, stones, cinders and other heavy inorganic

material

influent inflow

lin. ft. lineal feet

mgd million gallons per day

mlss mixed liquor suspended solids

ppm parts per million

ss suspended solids

TDH total dynamic head (usually refers to pressure on a pump

when it is in operation)



INCEPTION

In 1956, the City Council of Port Arthur in conjunction with R. V. Anderson and Associates initiated plans for a new primary sewage disposal plant and extension to existing sewers.

APPROVAL

Ontario Municipal Board approval was received for the above project in April of 1958 and the final agreement between the City of Port Arthur and the OWRC was signed during the same month.

CONSTRUCTION

In May, 1958, a contract for the construction of storm relief and sanitary trunk sewers was awarded to Hacquoil's Construction. The cost of the 0.76 miles of storm relief sewers was estimated at \$152,909.20 and the cost of the 2.22 miles of sanitary trunk sewers was estimated at \$1,078,652.32 for a total of \$1,265,057.17.

The Foundation Company was awarded the contract for the construction of the primary treatment plant in June, 1958, at an estimated cost of \$699,544.00.

Construction, which was supervised by the Commission's Division of Construction, officially began in August, 1958. Construction was substantially completed, and the systems put into operation, early in 1960.

The plant was officially opened on June 15, 1961.

During 1962, construction workwas carried out to increase the plant capacity from 2.0 MGD to 4.0 MGD and was completed during 1963. The new equipment and additions included an extension to the trunk interceptor sewer; two new settling tanks; a new 29,000 gpm storm pump, and a new 48 inch barminutor.

TOTAL COSTS

58-S-13 - \$2,156,991

62-S-101 - \$ 241,909



Project Staff

R. Romanick

Chief Operator

R. W. Johnstone Operator

COMMENTS

There was considerable staff turnover in 1965 subsequent to the resignation of Mr. E. J. Hughes and S. Hrymnak. Operators were hired on a casual basis for the remainder of the year.

The positions have since been filled with regular staff.

Mr. R. W. Johnstone served throughout 1965 as operator.



PRIMARY CLARIFIERS

Description of Project

GENERAL

At present, the plant is designed to give primary treatment with heated sludge digestion to 4,000,000 gallons of sewage per day. The plant is now capable of serving 40,000 persons and can be ultimately enlarged to a secondary treatment plant with a capacity of 16,000,000 gallons per day and serving 80,000 people.

The facilities presently include a combined lift station and control building, two grit channels, four primary sedimentation tanks, a heated sludge digester, four sludge drying beds, a chlorine contact chamber and one chlorine feeder.

CONTROL BUILDING

This building houses the raw sewage pumps, motors, storm pump, electrical controls, heat exchanger, sludge pumps, office, laboratory and limited storage space. There is also room for the installation of future equipment necessary for expansion.

LIFT STATION

The raw sewage enters the wet well

through a 60" diameter gravity sewer at sub-basement level. It is coarse screened before passing through two barminutors which cut and shred any solid material in the sewage. Before the sewage enters the wet well, it passes through an influent manhole which houses a control gate and a by-pass line. Due to the hydraulics of the sewer and wet well, this control gate has to be kept partially closed to avoid flooding the wet well. It is also impossible to use the by-pass without flooding basements upstream in Port Arthur.

Sewage is lifted by two 5,000 gallons per minute pumps approximately 40' to the grit channels. Each pump is equipped with a 75 H. P. electric motor, and one is also equipped with a 90 H. P. diesel motor which acts as a standby power source in case of electrical power failures.

GRIT CHANNELS

Sand and grit is allowed to settle in two parallel grit channels, each 35' x 3' x 5' deep and having a detention time of 4.7 minutes at design flow. After leaving the grit channels, the sewage flows through the flow meter.

PRIMARY SEDIMENTATION

From the grit channels, the sewage flows into four rectangular primary settling tanks. These tanks each measure 100' x 18' x 8' deep and have travelling combination scum skimmers and sludge collectors. The retention time is 2.14 hours at design flow, however, their combined maximum hydraulic capacity is 8 MGD, but at a reduced efficiency.

The sludge and scum collected in the primary tanks flows by gravity to an 11' x 11' x 10' deep raw sludge hopper, from which it is pumped by a 150 GPM, raw sludge pump to the digester.

In the event of a failure of the regular sludge and recirculation pumps, a 150 GPM standby pump powered by a 6 H. P. motor is provided.

CHLORINATION

The primary tank effluent flows into the chlorine contact chamber where its bacterial content is reduced by the addition of chlorine. The chlorine contact chamber measures 45' x 20' x 10' deep and has a retention time of 20 minutes at design flow. The gas chlorinator has a capacity of 400 pounds per day.

The chlorine tank effluent is discharged to the McIntyre River through an effluent sewer equipped with a flap gate to prevent back-flow from the river.

DIGESTION

The sludge collected in the two primary tanks is pumped from the raw sludge hopper to the digester. The sludge is heated to an average temperature of 93° Fahrenheit and is broken down by bacterial action into:

- 1. A thick, black, odourless sludge.
- 2. A relatively clear supernatant liquor which is returned to the wet well.

3. A digester gas which is utilized to heat the digester.

Natural gas is used as a standby fuel. The digested sludge is drained out onto the sand drying beds periodically throughout the warm season. The sludge is allowed to dry on the beds into a manageable sludge cake, and is then disposed of as a soil conditioner. Facilities are also available for disposal of this digested sludge in liquid form by tank trucks.

The digester measures 50 feet in diameter by 20 feet side wall depth. It has a capacity of 50,000 cubic feet or 312,000 gallons. This capacity allows for 1.25 cubic feet per capita at design flow.

The four drying beds have a total area of 10,000 square feet which represents 0.25 square feet per capita per year at design flow.



29,000 GPM STORM PUMP (40 MGPD)

PROJECT COSTS

NET CAPITAL COST (Final)	: 58-S-13 62-S-101		\$2,157,635.72 699,693.96
			\$2,857,329.68
DEDUCT: Portion Financed	By CMHC- 58-S-13 62-S-101	\$457,785.36	
Payments From M	Iunicipalities- 58–S–13 62–S–101	644.42	458, 429. 78
Long Term Debt to OWRC			$\frac{\$2,398,899.90}{$
Debt Retirement Balance at	Credit (Sinkin	g Fund) Decemb	er 31, 1965:
	58-S-13 62-S-101	\$306,601.88 11,522.77	
			\$ 318, 124. 65
Net Operating	58-S-13 62-S-101	\$ 44,533.19 36.90	44,570.09
Debt Retirement	58-S-13 62-S-101	\$ 43,530.00 4,882.00	48,412.00
Reserve	58-S-13 62-S-101	\$ 11,120.01 4,801.23	15, 921. 24
Interest Charges	58-S-13 62-S-101	\$121,023.04 <u>15,027.22</u>	136, 050, 26
TOTAL			\$ 244,953.59

RESERVE ACCOUNT

Balance at January 1, 1965		\$82, 103. 92	
	62 - S-10 1	6,858.77	\$ 88,962.69
Deposited by Municipality	58 - S-13	11, 120. 01	
Doposito a sij inamioipanisj	62-S-101	4,801.23	15,921.24
Interest Earned	58 - S-13	4,782.10	
interest Harned	62-S-101	482.97	5, 265. 07
			\$ 110,149.00
Less Expenditur	es		-
Balance at December 31, 1	1965		\$ 110,149.00

MONTHLY OPERATING COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	SUNDRY	WATER
JAN	2042,20	1072.98	294.00		433.17		81.99		160.00		
FEB	3025.33	1072,98	398.95	180.25	432.63		78,66		15 _• 45	846.41	
MARCH	2561.05	1265.80	269,92	182.82	442.42		187.72	77,25	111.79	23.33	
APRIL	2496,32	1632.18		180.93	430.07		5 0.7 6			23,59	178,79
MAY	3800.24	1986.99	639.08	163.38	531.99	·	266.16		73.81	138.83	
JUNE	3384.96	1125.74	584.24	126.46	618.97	448.05	221.45	23,69	67.30	169,06	
JULY	3532.84	1021.15	613.93	121.79	459.06	448.05	91.81		342,08	39.74	395.23
AUG	2859.48	785.12	817.38	110.35	466,66	448,05	89.86		31.13	110.93	
SEPT	3832,23	934,46	1095.84	36.00	399.82	896,10	218.88	92.47	123.24	35.42	
ост	6309,55	1773,15	1129.20	36,00	467,06	448.05	144.58	42.93		1665.45	603.13
NOV	5701.63	841.93	863.57	51.45	455.12	448.05	198.80	432.89	10.66	2393, 17	
D€C	4987 , 36	813.47	718.82	124.87	447.09		331.46	677.97	381.19	897.46	595.03
TOTAL	44533, 19	14325.94	7424.93	1314.30	5584,06	3136.35	1962,13	1347.20	1322.71	6343.39	1772, 18

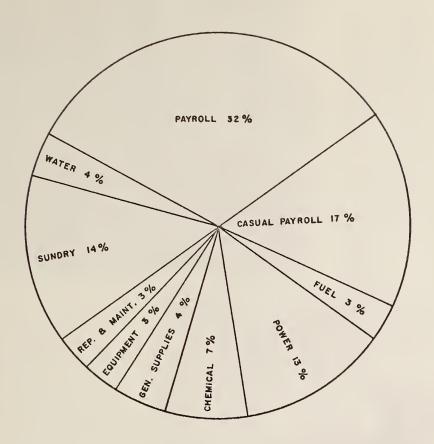
^{*} SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE \$4758.60
BRACKETS INDICATE CREDIT

YEARLY OPERATING COSTS

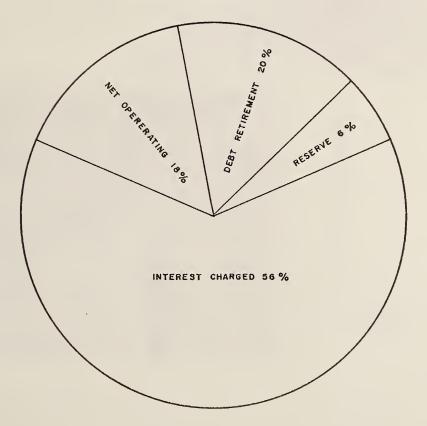
YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY * PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	840.41	\$ 29,861.94	\$ 2.77	\$ 35.52	3 CENTS
1962	885•49	31,781.54	2.85	35,89	4 CENTS
1963	1063.67	32,700.58	2.89	34.74	3 CENTS
1964	I648 _• 94	45,374.87	3.94	27.52	4 CENTS
1965	1883,74	44,533,19	3.82	23,64	3 CENTS

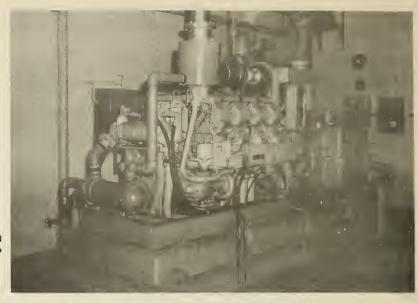
^{*} BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

1965 OPERATING COSTS

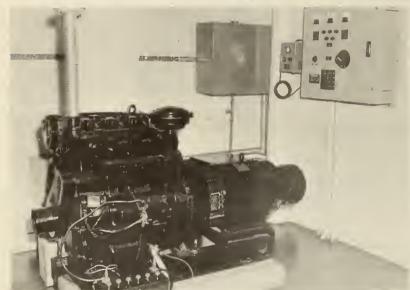


TOTAL ANNUAL COST (BOTH PROJECTS)

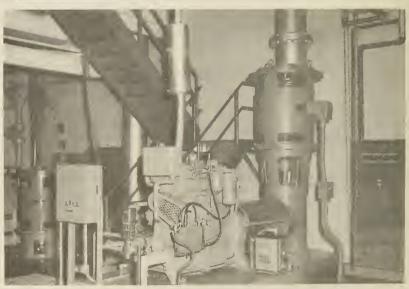




DORMAN DIESEL ENGINE (400 HP) ON STORM PUMP



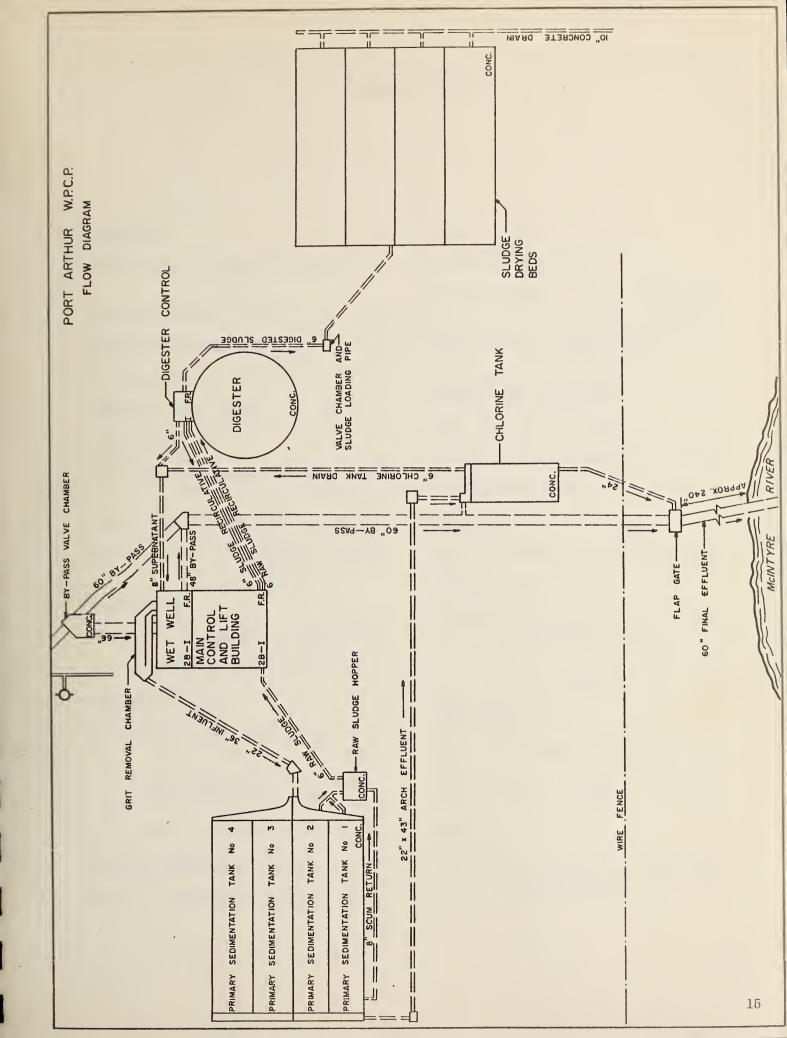
THIS 18 KW GENERATOR SET SUPPLIES POWER TO ALL EMERGENCY EQUIPMENT IN CASES OF POWER FAILURE



90 HP CUMMINS DIESEL ENGINE ON STANDBY. ALSO SHOWN IS 75 HP ELECTRIC MOTOR ON MAIN PUMP.

Technical Section







Design-Data

GENERAL

Type of Plant - Primary treatment with digester.

Design Population - 40,000.

Design Plant Flow - 4 MGD.

Per Capita Flow - 100 GPD.

PRIMARY TREATMENT

Grit Removal

Type - two rectangular parallel grit channels.

Size - 35' x 3' x 5' deep.

Detention Time - 4.7 minutes at 2 MGD per channel.

Barminutors

Sizes - one 35" model B Barminutor.

- one 48" model A1 Barminutor.

Sewage Lift Pumps

Sizes - one 29,000 GPM driven by a diesel engine.

- two 3,300 GPM - each driven by a 75 HP electric motor.

- one with a 90 HP diesel engine.

Primary Sedimentation Tanks

Type - 4 rectangular parallel units.

Size - 18' x 100' x 8' deep.

Retention - 2.14 hours.

Surface Settling Rate - 560 gallons per sq. ft. per day.

Overflow Rate - 6,000 gallons per ft. of weir per day.

Chlorine Contact Chamber

Size - 45' x 20' x 10' deep.

Retention Time - 20 minutes at 4 MGD.

Chlorinator Capacity - 400 lbs. per day.

Digester

Size - 50 ft. in diameter by 20 ft. deep.

Capacity - 312,000 gallons.

Loading - 1.25 cubic ft. per capita (population 40,000).

- 2.0 lbs. of solids per cubic ft. per month.

Sludge Drying Beds

Size - 4 for a total area of 10,000 sq. ft.

Area per capita - 225 sq. ft. @ 40,000 persons.

Outfall

Size - 240 ft. of 60 inch diameter corrugated metal pipe discharging into the McIntyre River.

Process Data

The daily average flow continues to show an upward trend, while the strength of the incoming sewage remained relatively unchanged from previous years.

During 1965 a total of 1883.74 mg of sewage was treated, an increase of 14% over 1964.

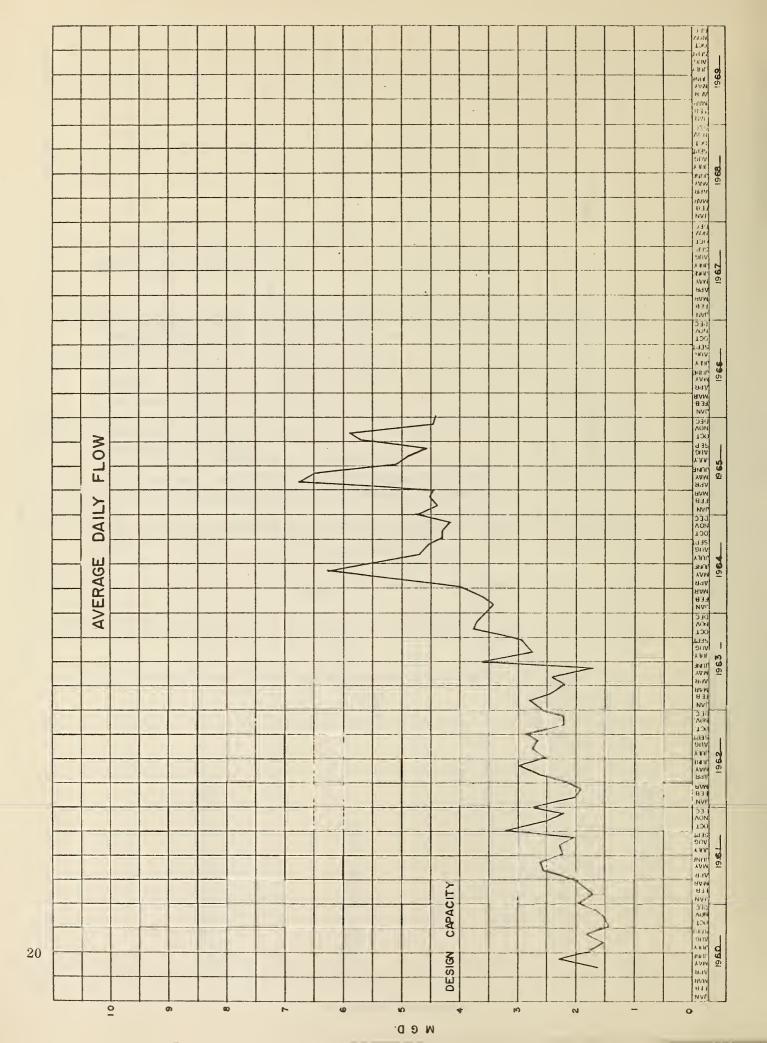
The daily average flow was 5.16 mgd, an overload of 29% over the plant capacity of 4.0 mgd.

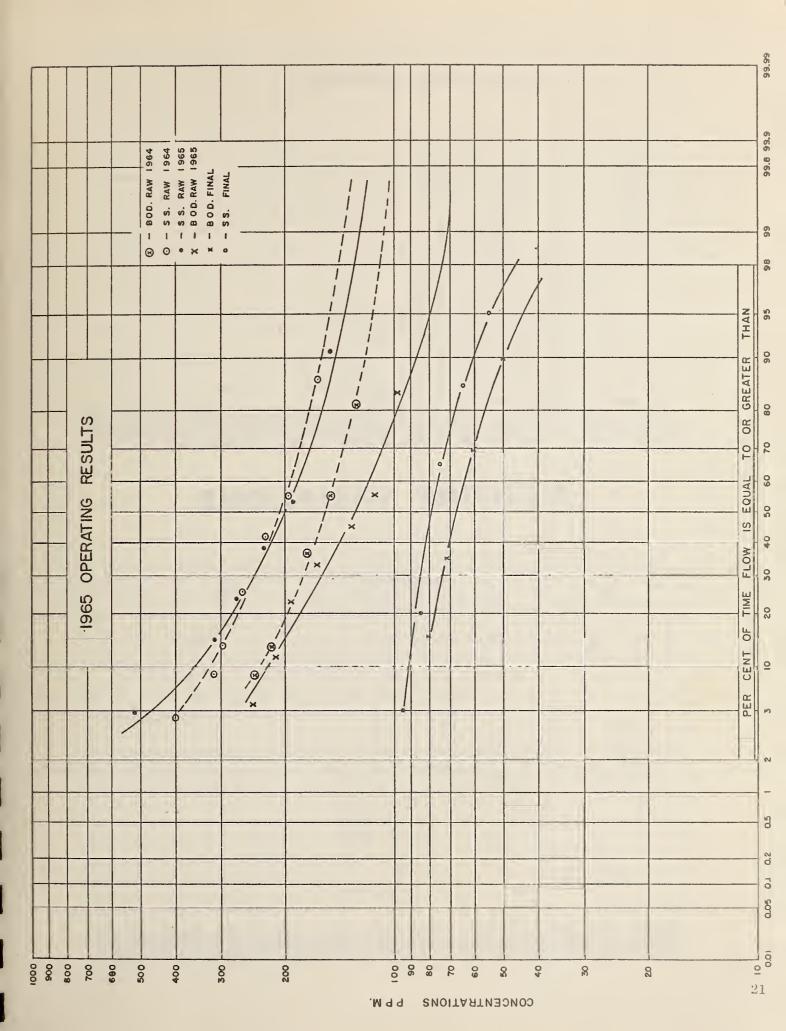
The average 5 day BOD of the raw sewage was 130 ppm and the average 5 day BOD of the plant effluent was 60 ppm, a reduction of 54%.

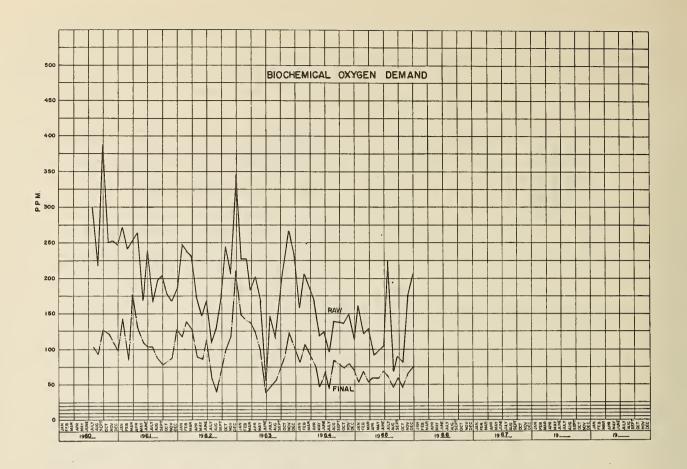
The comparable figures for SS were 204 ppm and 73 ppm, a reduction of 64%.

PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN

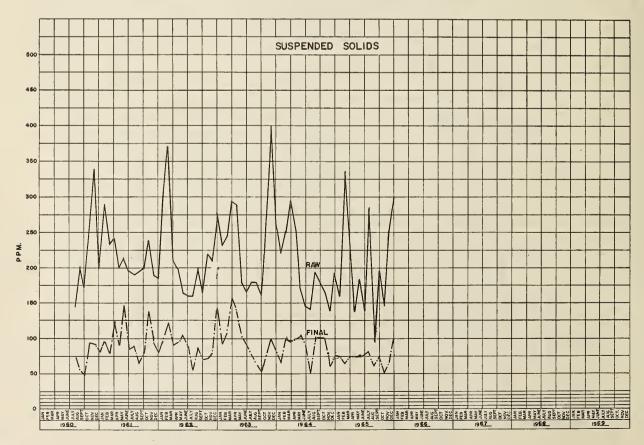
19







MONTHLY VARIATIONS

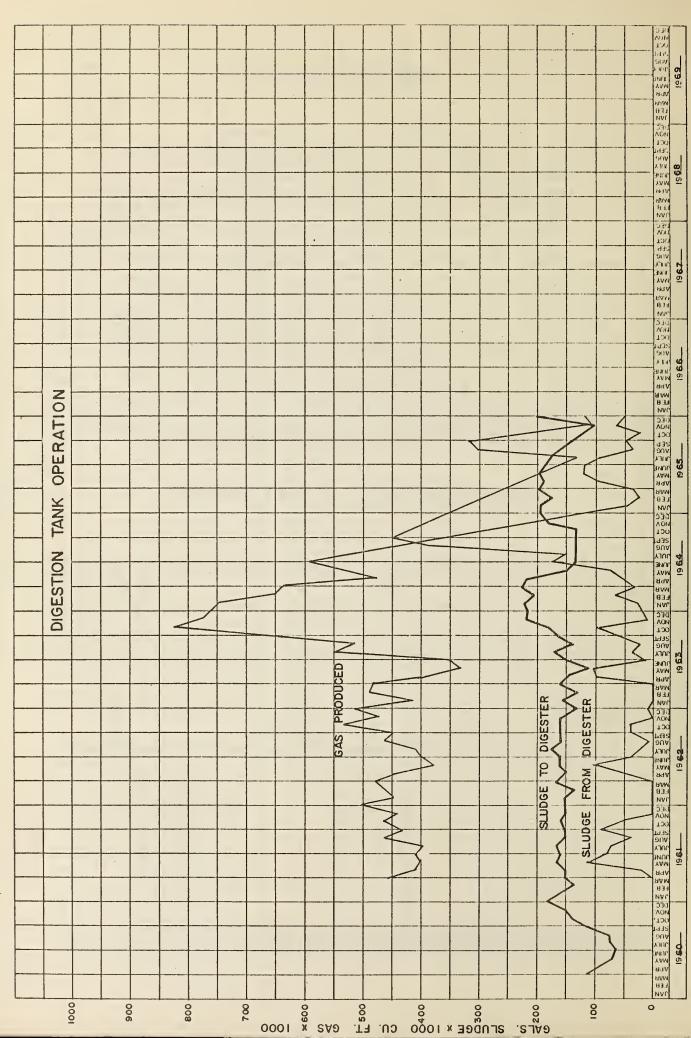


GRIT, B.O.D AND S.S. REMOVAL

	B. O. D.					S. S.			
MONTH	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT PPM.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	GRIT REMOVAL CU. FT.
JAN.	1.65	54	67.0	75.1	160	75	53.0	57. 5	136
FEB.	122	69	43.5	33.3	338	65	80.5	171.5	112
MAR.	130	55	57.5	51.7	211	76	64.0	93.0	172
APR.	92	60	34.5	32.6	133	75	43.5	59.0	180
MAY	100	58	42.0	42.2	189	74	61.0	115.5	263
JUNE	105	70	33.5	29.1	136	76	44.0	50.0	2 3 8
JULY	220	62	72.0	119.4	291	82	72.0	158.0	146
AUG.	68	46	32.0	15.5	94	63	33.0	21.9	226
SEPT.	92	62	32.5	25.4	205	75	63. 5	110.2	189
ост.	81	46	43.0	31.9	144	52	64.0	83.8	225
NOV.	178	66	63.0	74.8	251	68	73.0	122.2	188
DEC.	205	76	63.0	88.1	300	100	66,5	136, 5	165
TOTAL				659.3	000			123.4	2240
AVG.	130	60	54.0	54.9	204	73	64.0	10.3	187

COMMENTS

Percent removals of BOD and SS are as would be expected for a primary plant.



DIGESTER OPERATION

				·	·		
	SLUDG	E TO DIGESTI	ERS	SLUDGE FROM DIGESTERS			
MONTH	1000'S CU FT.	% SOLIDS	% VOL. MAT.	1000'S CU.FT.	% SOLIDS	% VOL. MAT	GAS PRODUCED 1000'S Cu. Ft.
JAN.	31.79	2.88	1.82	timed	para	igno	44.47
FEB.	28.72	2.86	une	gues .	gang	b-30	25.97
MAR.	31. 79	-	ting	-	pup	emin	36, 81
APR.	30.77	2, 23	1.65	phod	gang .	-	62, 44+
MAY	31. 79		-		and ,	Chris	120.50
JUNE	30.77	-	-	gine#	comi	gu-é	121.43
JULY	28.72	-	-	*21,22	, BIA6	-	98. 52
AUG.	tine	-	gang .	*49.30		E49	dend
SEPT.	-	-	End.	*H 51.38 TB 8.69	gusts.	que	-
ост.	e=0	-	=	* 37. 42	gen	guo .	++ 26.06
NOV.	16.82	-		17.23	wind	860	65. 36
DEC.	33. 23			19.30			56, 45
TOTAL	264.40			H 195.85 TB 8.69			658.01
AVG.	29.38			H 32.64 8.69			65.80

H - Hauled

COMMENTS

Digester operation was poor in 1965, mainly due to formation of scum mats in the digester. This put the digester out of operation for a 2 month period. The problem was overcome by moving the standby recirculation pump from the control building to the digester building. Piping head loss was therefore greatly reduced and adequate mixing of digester contents can now be achieved. It is improbable that scum blankets will now form.

TB- To beds

⁺²³ days data - meter out of order

^{*} Tank Truck haulage. Digester down.

^{+ 15} days data. meter returned to service.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	135.32		900
FEBRUARY	125.63		
MARCH	137.86		-
APRIL	203.49	and .	enen
MAY	200.80	* 2055	1.76
JUNE	166, 50	4191	2. 52
JULY	151. 16	4340	2.87
AUGUST	141.05	** 2779	2.91
SEPTEMBER	169.54	3940	2,32
OCTOBER	182.26	4104	2.25
NOVEMBER	133.60	*** 109	1, 22
DECEMBER	136.53		•••
TOTAL	1883.74	21518	
AVERAGE	156.98	3074	2.42

^{* 18} days chlorination

COMMENTS

Chlorination was carried out from late May to early November and 21518 pounds of chlorine were used to maintain a residual of 0.5 ppm. Modifications to the chlorine feed will have to be made to cope with the increasing flows.

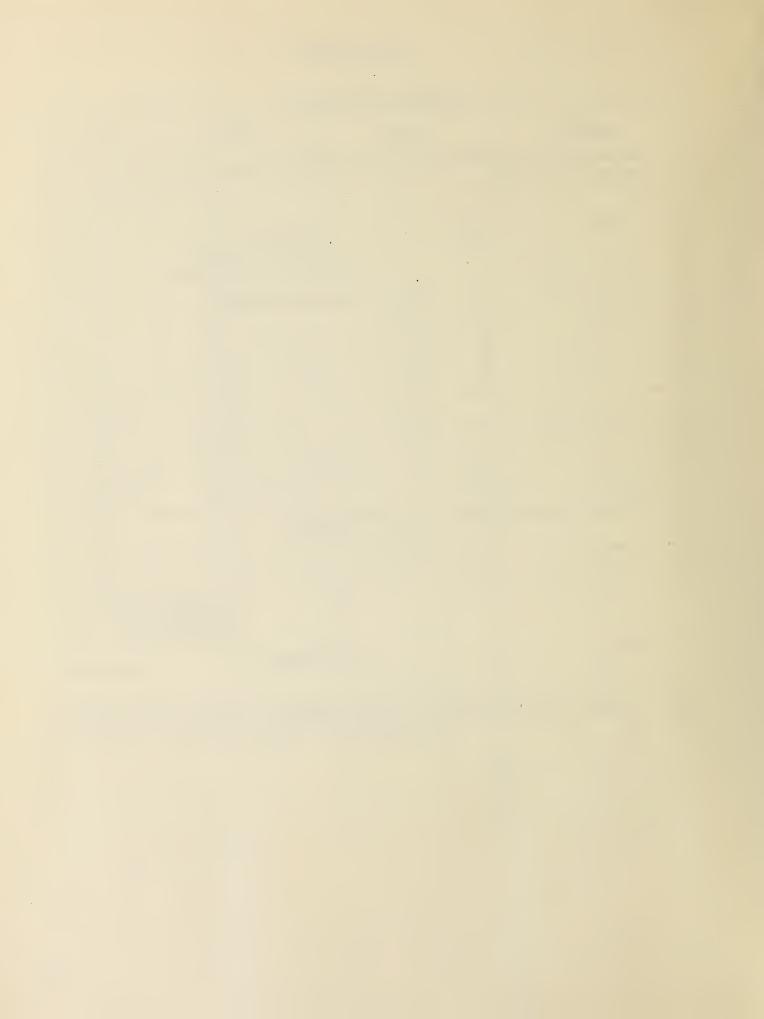
^{** 21} days chlorination

^{*** 2} days chlorination

DORMAN DIESEL

Listed below are Dorman Diesel pumpage values in hours for 1965, and operator's comments:

Date	Hrs.	Comments
Jan 24 - 30	2	test following installation
Feb 21 - 27	1	test and inspection
Apr 7 8 9 10 11 - 17	9 7 11 8 75. 5	
May 16 - 22 23 - 29	$\begin{array}{c} 21 \\ 2 \end{array}$	
Jun 27	5.9	
Jul 1 13	6 4	rain storm
Aug 5 6 12 27 30	2 3 2 3 1	11 11 11 11
Sep 14 15 21 29 30	15 6 2 12 24	on storm pump '' rain storm
Oct 1 2 3 4 7	20 21 15 6 5 9	11 11 11 11



CONCLUSIONS

The increasing flows are taxing the existing plant facilities and close control must be exercised on grit removal, raw sludge pumping, digester operation and chlorination of final effluent. There is no indication that the trend of increase in flow has changed since 1963 through 1964 and 1965.

RECOMMENDATIONS

Consideration should be given to increasing the capacity of treatment facilities at this plant.



